

Ecological Site Description—Rangeland

Shale, 10–14" MAP

MLRA: 58A – Sedimentary Plains, East

MLRA: 60B – Pierre Shale Plains, East

R058AE075MT, R060BE575MT

Site Name: Shale (Sh), 10–14 inches Mean Annual Precipitation (MAP)**Site Number:** R058AE075MT, R060BE575MT**Major Land Resource Areas:**
58A – Northern Rolling High Plains, North Part
60B – Pierre Shale Plains, North Part**Rangeland Resource Units:**
58AE – Sedimentary Plains, East
60BE – Pierre Shale Plains, East

1. Physiographic Features: This ecological site occurs on hills, plains, and terraces in shale uplands. Slopes range from 0–45%, but generally are less than 8%. This site occurs on all exposures and aspect is not significant. Outcroppings of shales often occur. This is a very barren and extremely low producing ecological site. This site is not very common, and tends to occur mainly in MLRA 60B.

Elevation (feet): 1,900–3,500**Landform:** hills, sedimentary plains, terraces**Slope (percent):** 0–45, but are mainly less than 8**Depth to Water Table (inches):** greater than 60**Flooding:** none**Ponding:** none**Runoff Class:** high to very high**Aspect:** not significant

2. Climatic Features: MLRAs 58A and 60B are considered to have a continental climate characterized by cold winters, hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are typical. The climate is the result of this MLRA's location in the geographic center of North America. There are few natural barriers on the northern Great Plains and the winds move freely across the plains and account for rapid changes in temperature. Seasonal precipitation is often limiting for plant growth. Annual fluctuations in species composition and total production are typical depending on the amount and timing of rainfall. See Climatic Data Sheet MLRA 58A, east and 60B, for more details (Section II of the NRCS Field Office Technical Guide). For local climate station information, refer to <http://www.wcc.nrcs.usda.gov>.

Frost-free period (32° F)-days: 105–145**Freeze-free period (28° F)-days:** 125–170**Mean annual precipitation (MAP):** 10–14 inches

3. Influencing Water Features: None

4. Associated sites: Shallow Clay and Coarse Clay.

5. Similar sites: Coarse Clay, Dense Clay, Saline Upland, and Claypan.

The Coarse Clay differs mainly by having a more diverse community of plants that are typically on a Sandy site.

The Dense Clay site has moderately deep to deep nongranular heavy clays that are overlain by thin ineffectual layers.

The Saline Upland site is dominated by salt tolerant plants.

The Claypan site is moderately deep to very deep soils that have a hard claypan layer at about 2–8 inches from the surface. These sites are all more productive and have a more diverse plant community.

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6. Soils: The soils associated with this ecological site are developed in consolidated (acidic and non-acidic) shales. Shale fragments often occur near the surface. These soils are mainly less than 20 inches deep, and typically have a water holding capacity of less than 2 inches. Colors are often dark due to the parent material (lithochromic) and not organic matter. Textures tend to be clayey.

Parent material (kind): alluvium, residuum**Parent material (origin):** semiconsolidated, often acidic shales**Surface textures:** mainly silty clay**Depth (inches):** 5–20**Soil surface permeability (inches per hour):** slow (.06–0.2)**Available Water Holding Capacity to 40" (inches):** 0.2–2**Drainage Class:** well**Salinity/Electrical Conductivity (mmhos/cm):** slightly to moderately saline (4–16)**Sodium Absorption Ratio (SAR):** 5–13**Reaction (pH) (1:1 water):** extremely acid to slightly acid (3.5–6.5)

6a. Representative Soils: Listed below are soils and map units which characterize this site in various counties. (Reference MT-165, Soil Interpretive Rating Report).

COUNTIES	TYPICAL SOILS	MAP UNIT
Carter (60B)	Volborg silty clay	198D
Custer (58AE)	Volborg silty clay	666C
Garfield (60B)	Volborg silty clay	253E
Rosebud (60B)	Volborg silty clay	191, 192
Wibaux	Lismas clay	La

7. Plant Community and Species Composition: The physical aspect of this site is that of a mixed grassland/shrubland that is typically dominated by medium to short grasses and sedges with a scattered amount of shrubs. Approximately 40–60% of the annual production is from grasses and sedges, 1–5% from forbs, and 20–35% is from shrubs and half-shrubs. Canopy cover of shrubs is 10–15%.

TABLE 7a–Major Plant Species Composition, lists plant species composition and production by dry weight for the Historic Climax (HCPC) or Potential Plant Community (PPC) for this site. The Historic Climax or Potential Plant community has been determined by the study of rangeland relict areas, enclosures, or areas protected from excessive grazing. Total annual production has been derived from several data sources, and has been adjusted to represent a typical annual moisture cycle for the site. Reference for plant species names and symbols: USDA–NRCS PLANTS Database at <http://plants.usda.gov>.

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7a. Major Plant Species Composition – Historic Climax/Potential Plant Community

Common Name	Plant Symbol	Plant Group	Percent Comp.	Group Max. %	Mean Annual Precipitation (MAP) (inches)				
					10	11	12	13	14
					(lbs./acre)	(lbs./acre)	(lbs./acre)	(lbs./acre)	(lbs./acre)
Grasses and Sedges 40–60%					120	165	210	255	300
Western/ Thickspike wheatgrass	PASM ELLAL	14	20-30		40-60	55-82	70-105	85-128	100-150
Montana wheatgrass	ELLAA	14	5-15		10-30	14-41	18-52	21-64	25-75
Prairie sandreed	CALO	5	0-20		0-40	0-55	0-70	0-85	0-100
Inland saltgrass	DISP	15	0-5	10	2-20 No more than 10 for any one	3-28 No more than 14 for any one	4-35 No more than 18 for any one	4-42 No more than 21 for any one	5-50 No more than 25 for any one
Sandberg bluegrass	POSE	12	1-5}						
Bottlebrush squirreltail	ELEL5	10	1-5}						
Other native grasses	2GP		1-5}						
Forbs 1–5%					10	14	18	21	25
Hairy goldenaster	HEVI4	23	1-5}	5	2-10	3-14	4-18	4-21	5-25
American vetch	VIAM	18	1-5}						
Buckwheat spp.	ERIOG	23	1-5}						
Biscuitroot spp.	LOMAT	24	1-5}						
Other native forbs	2FP		1-5}						
Shrubs and Half-shrubs 20–35%					70	96	122	149	175
Slenderbush eriogonum	ERMI4	37	5-10	35	10-20	14-28	18-35	21-42	25-50
Longleaf sagebrush	ARLO7	37	5-10		10-20	14-28	18-35	21-42	25-50
Wyoming big sagebrush	ARTRW8	37	0-5		0-10	0-14	0-18	0-21	0-25
Rubber rabbitbrush	ERNAN5	36	0-5		0-10	0-14	0-18	0-21	0-25
Winterfat	KRLA2	35	1-20}		2-70 No more than 40 for any one	3-96 No more than 55 for any one	4-122 No more than 70 for any one	4-149 No more than 85 for any one	5-175 No more than 100 for any one
Nuttall's saltbush	ATNU2	34	1-20}						
Greasewood	SAVE4	37	1-20}						
Shadscale	ATCO	34	1-20}						
Other native shrubs	2SB		1-20}						
Broom snakeweed	GUSA2	37	0-T	T	T	T	T	T	T
Plains pricklypear	OPPO	38	0-T		T	T	T	T	T
Total Annual Production: (lbs./acre)			100%		200	275	350	425	500

7b. Plant Group Descriptions: Plant functional groups are based on: season of growth, growth form, stature, type of root system, and ecological response to disturbance. Refer to Field Office Technical Guide (FOTG) Section II for a complete description of plant groups.

8. Total Annual Production: Total annual production is a measurement of the total aboveground production (dry weight) of all major plant species that occur on the site during a single growth year, regardless of accessibility to grazing animals. This information is listed at the bottom of TABLE 7a.—Major Plant Species Composition. Average production values are listed for each incremental inch of precipitation for the site.

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9. Cover and structure: The following table shows the approximate amounts of basal cover, canopy cover, and plant heights for this site in the Historic Climax or Potential Plant Community.

COVER TYPE	BASAL COVER (%)	CANOPY COVER (%)	AVERAGE HEIGHT (inches)
Cryptograms	0 – T	0 – T	0.25
Grasses/ sedges	1 – 5	10 – 15	24
Forbs	T – 1	T – 5	18
Shrubs	1 – 2	10 – 15	24
Litter	5 – 10		
Coarse fragments	0 – 1		
Bare ground	75 – 85		

10. Ecological Dynamics: This site developed under Northern Great Plains climatic conditions, which included the natural influence of large herbivores and occasional fire. The plant community upon which interpretations are primarily based is the Historic Climax Plant Community (HCPC) or Potential Plant Community. This community is given as a reference to understand the original potential of this site, and is not always considered to be the management goal for every acre of rangeland. The following descriptions should enable the landowner or manager to better understand which plant communities occupy their land, and assist with setting goals for vegetation management. It can also be useful to understand the environmental and economic values of each plant community.

Due to the severe soil limitations of this site, species diversity and total annual production is very low. Soil erosion is high due to the high proportion of bare ground.

Continual adverse impacts to this site over a period of years will result in the decrease of the medium grasses and shrubs, such as **western wheatgrass, greasewood, and Nuttall's saltbush**.

Continued disturbances will cause the loss of the greasewood, winterfat, and shadscale. The shrubs will be replaced by **longleaf sagebrush** once the ecological threshold has been crossed.

Plants that are not a part of the climax community that are most likely to invade are **plains pricklypear and broom snakeweed**.

10a. Major Plant Community Types: Following are descriptions of several plant communities that may occupy this site.

Plant Community 1: Medium Grasses/ Tall Shrubs: This is the interpretive plant community and is considered to be the Historic Climax Plant Community (HCPC) or Potential Plant Community (PPC) for this site. This plant community contains a low diversity of medium cool season grasses (**western and thickspike wheatgrass, Montana wheatgrass, Sandberg bluegrass, and bottlebrush squirreltail**). A few forbs occur in small percentages. Shrubs that occur on this site include **winterfat, shadscale, greasewood, and Nuttall's saltbush**. Due to the severe soil limitations of this site, species diversity and total annual production is very low.

Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Plant litter is very limited due to low annual productivity. This plant community provides for limited soil stability as bare ground is commonly greater than 75% cover.

Plant Community 2: Medium Grasses/ Medium and Low Shrubs: Slight variations in the Historical Climax Plant Community result in a community where the diversity of shrubs is lowered. Species that tend to dominate include **western wheatgrass, Nuttall's saltbush, and slenderbush eriogonum**.

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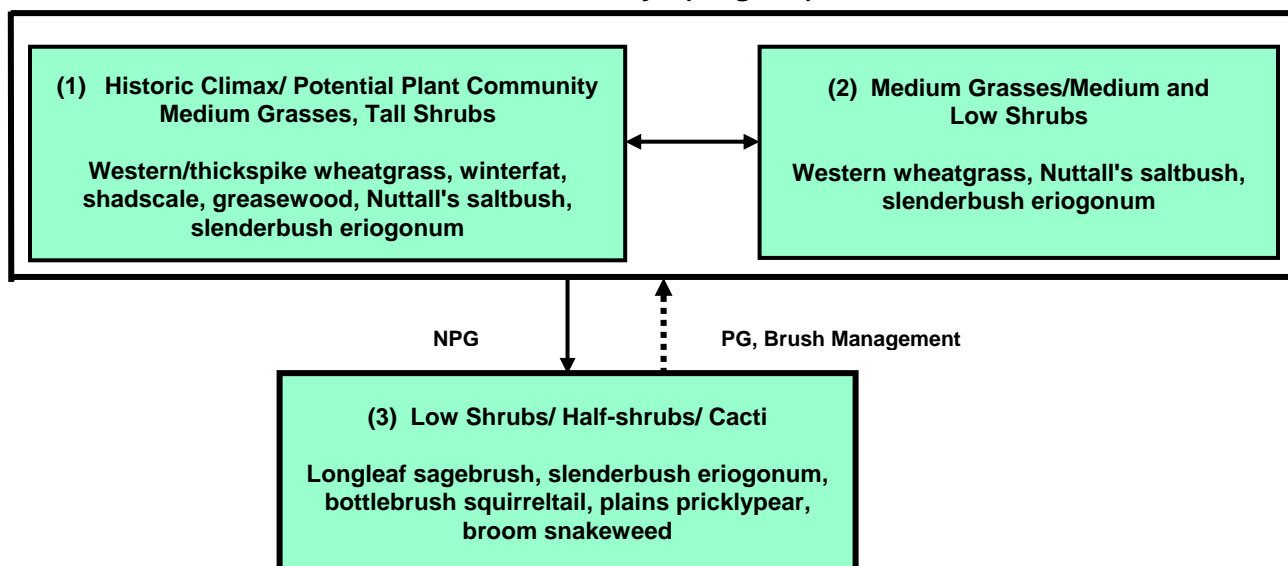
Plant Community 3: Low Shrubs/ Half-shrubs / Cacti: With continual adverse impacts to Plant Community 2, the plant community tends to become dominated by species such as **longleaf sagebrush, slenderbush eriogonum, and bottlebrush squirreltail**. There may still be remnant amounts of some of the mid-seral species such as western or thickspike and Montana wheatgrass. **Broom snakeweed** often invades this site.

Grass biomass production and litter become reduced on the site as the grasses disappear, increasing evaporation and reducing moisture retention. Additional open space in the community can result in undesirable invader species. This plant community provides for extremely low soil stability.

These communities will respond positively to improved grazing management, but significant economic inputs and time would be required to move them toward a higher successional stage and a more productive plant community.

10b. Plant Communities and Transitional Pathways (State and Transition Model): Transitions in plant community composition occur along a gradient that is not linear. Many processes are involved in the changes from one community to another. Changes in climate, elevation, soils, landform, fire patterns and frequency, and grazing all play a role in determining which of the plant communities will be expressed. The following model outlines some of the various plant communities that may occur on this site and provides a diagram of the relationship between plant community and type of use or disturbance.

Plant Communities and Transitional Pathways (diagram)



Smaller boxes within a larger box indicate that these communities will normally shift among themselves with slight variations in precipitation and other disturbances. Moving outside the larger box indicates the community has crossed a threshold (heavier line) and will require intensive treatment to return to Community 1 or 2. Dotted lines indicate a reduced probability for success.

NOTE: Not all species present in the community are listed in this table. Species listed are representative of the plant functional groups that occur in the community.

PG = Prescribed Grazing: Use of a planned grazing strategy to balance animal forage demand with available forage resources. Timing, duration, and frequency of grazing are controlled and some type of grazing rotation is applied to allow for plant recovery following grazing.

NPG = Non-Prescribed Grazing: Grazing which has taken place that does not control the factors as listed above, or animal forage demand is higher than the available forage supply.

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11. Plant Growth Curves: Growth of native cool-season plants begins in April and continues to the end of June. Native warm-season plants begin growth about mid May and continue to about the end of August. Green up of cool-season plants can occur in September through October when adequate soil moisture is present. The following tables show the approximate percentage of total growth by month that is expected to occur in various plant communities on this site for a "typical" moisture year.

Growth Curve Number: MT0813

Growth Curve Description: Includes all low condition sites in eastern sedimentary plains sites, dominated by short grasses.

Totals for Each Month

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	0	0	25	25	25	10	10	5	0	0	0

Cumulative Totals by Month

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	0	0	25	50	75	85	95	100	0	0	0

Growth Curve Number: MT0814

Growth Curve Description: Includes all low condition sites in eastern sedimentary plains sites including 10% or more shrubs.

Totals for Each Month

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	0	0	5	25	40	15	10	5	0	0	0

Cumulative Totals by Month

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	0	0	5	30	70	85	95	100	0	0	0

Growth Curve Number: MT0817

Growth Curve Description: Includes Shale sites in eastern sedimentary plains sites.

Totals for Each Month

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	0	5	25	35	30	5	0	0	0	0	0

Cumulative Totals by Month

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	0	5	30	65	95	100	0	0	0	0	0

12. Livestock Grazing Interpretations: This plant community is not well suited to managed livestock grazing due to low forage production. The steeper slopes may also limit livestock travel and result in poor grazing distribution, especially in areas away from water. Management objectives should include maintenance or improvement of the vegetation community. Short grazing periods and adequate re-growth after grazing are recommended for plant recovery. Season long use of this site can be detrimental, causing an increase in bare ground and altering the plant community over time.

Whenever Plant Community 2 occurs (medium grasses and shrubs), grazing management strategies need to be implemented to avoid further deterioration.

It is not feasible to improve the site when the dominant community type is similar to 3. Often, when this site is in this condition, there is a significant amount of erosion pavement or bare ground present. Community 3 has lost most of the attributes of healthy rangeland, including good infiltration, minimal erosion and runoff, nutrient cycling and energy use.

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12a. Calculating Safe Stocking Rates: Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. Safe stocking rates will be based on useable forage production, and should consider ecological condition and trend of the site, and past grazing use history.

Calculations used to determine a safe stocking rate are based on the amount of useable forage available, taking into account the harvest efficiency of the animal and the grazing strategy to be implemented. Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

12b. Guide to Safe Stocking Rates: The following charts provide a guide for determining a safe stocking rate. Animal Unit Month (AUM) figures are based on averages of forage production from data collected for this site over several years. The characteristic plant communities and production values listed may not accurately reflect the productivity of a specific piece of land, hence this table should not be used without on-site information as to current forage productivity of the site. Adjustments to stocking rates for each range unit must be made based on topography, slope, distance to livestock water, and other factors, which effect livestock grazing behavior.

12c. Stocking Rate Guide:

Major Plant Community Dominant Plant Species	MAP	Total Production (lbs./ac)	Cattle			Sheep		
			Forage Production	AUM/ac	Ac/AUM	Forage Production	AUM/ac	Ac/AUM
1. Medium Grasses/ Tall Shrubs (HCPC/PPC) <i>Western/ thickspike wheatgrass, winterfat, Nuttall's saltbush, shadscale, greasewood, slenderbush erigonum</i> (S.I. >70%)	13–14"	425 – 500	300 – 375	.08 – .10	10.0 – 12.5	350 – 400	.09 – .11	9.1–11.1
	10–12"	200 – 350	150 – 250	.04 – .05	20 – 25	150 – 300	.04 – .08	12.5–25.0
2. Medium Grasses/ Medium and Low Shrubs <i>Western wheatgrass, Nuttall's saltbush, slenderbush erigonum</i> (S.I. 55–75 %)	13–14"	350 – 425	225 – 275	.05 – .06	16.7 – 20.0	250 – 300	.06 – .07	14.3–16.7
	10–12"	175 – 300	100 – 200	.02 – .04	25 – 50	125 – 225	.03 – .05	20–33.3
3. Low Shrubs/ Half-shrubs/ Cacti <i>Longleaf sagebrush, slenderbush erigonum, bottlebrush squirreltail, plains pricklypear, broom snakeweed</i> (S.I. < 40%)	10–14"	100 – 250	50 – 125	.01 – .02	50 – 100	75 – 150	.01 – .02	50–100

Stocking rates are calculated from average forage production values using a 25% Harvest Efficiency factor for preferred and desirable plants, and 10% Harvest Efficiency for less desirable species. AUM calculations are based on 790 pounds per animal unit month (AUM) for a 1,000-pound cow with calf up to 4 months. No adjustments have been made for site grazability factors, such as steep slopes, site inaccessibility, or distance to drinking water.

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12d. Plant Forage Preferences for Cattle and Sheep

Legend: P=Preferred D=Desirable U=Undesirable E=Emergency
N=Nonconsumed T=Toxic Blank=Unknown or no data

Winter (W) = Jan., Feb., March; Spring (SP) = April, May, June;
Summer (SU) = July, Aug., Sept.; Fall (F) = Oct., Nov., Dec.

	Cattle				Sheep			
PLANT NAME	W	SP	SU	F	W	SP	SU	F
Western wheatgrass	P	D	D	P	D	D	D	D
Thickspike wheatgrass	P	P	P	P	P	P	P	P
Sandberg bluegrass	D	D	D	D	D	D	D	D
Montana wheatgrass	P	P	P	P	P	P	P	P
Inland saltgrass	NE	N	NE	NE	U	U	U	U
Prairie sandreed	D	D	D	D	D	D	D	D
Bottlebrush squirreltail	D	D	D	D	U	D	D	U
Hairy goldenaster	N	N	N	N	N	D	D	D
American vetch	N	P	P	D	N	P	P	D
Buckwheat spp.	N	U	N	N	N	D	U	N
Biscuitroot spp.	N	P	P	D	N	P	P	D
Winterfat	P	P	P	P	P	D	D	P
Nuttall's saltbush	P	P	P	P	P	P	P	P
Slenderbush eriogonum	N	N	N	N	U	U	U	U
Longleaf sagebrush	N	N	N	N	U	U	U	U
Rubber rabbitbrush	U	U	U	U	U	U	U	U
Wyoming big sagebrush	N	N	N	N	P	D	D	P
Shadscale	U	U	U	U	D	D	D	D
Greasewood ^{1/}	N	N	N,E	N,E	D	U, T	U	D
Broom snakeweed ^{2/}	N	N	N	U	U	U	U	U
Plains pricklypear ^{3/}	N	N	N	N	U	U	U	U

^{1/} Can be toxic to sheep in spring if large quantities are ingested.

^{2/} Broom snakeweed can be poisonous, but this is not usually a problem in Montana because plants die back in winter and do not have green leaves in early spring.

^{3/} The spines can be injurious to livestock.

13. WILDLIFE INTERPRETATIONS: The following is a description of habitat values for the different plant communities that may occupy the site:

Plant Community 1: Medium Grasses/ Tall Shrubs (HCPC or PPC): The high percentage of nutritious shrubs and half-shrubs favors browsers and mixed feeders like mule deer and pronghorn, particularly on winter range. Seed production from shadscale, greasewood and other shrubs and half-shrubs supports seed-eating small mammals such as deer mice and kangaroo rats. Ground-nesting bird habitat is limited. Common nighthawks, loggerhead shrikes and Brewer's sparrows are potential breeding birds. A variety of raptors hunt small mammals, insects and birds in this habitat.

Plant Community 2: Medium Grasses/ Medium and Low Shrubs: Big game habitat value declines with the loss of winterfat and other browse plants. General habitat diversity declines with a partial loss of vegetative structural diversity. If big sagebrush increases, Brewer's sparrow may benefit.

Plant Community 3: Low Shrubs/ Half-shrubs/ Cacti: Wildlife habitat values are quite low in this community following the loss of plant species products and structural diversity.

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13a. Plant Preferences for Antelope and Deer:

Legend: P=Preferred D=Desirable U=Undesirable E=Emergency
N=Nonconsumed T=Toxic Blank=Unknown or no data
Winter (W) = Jan., Feb., March; Spring (SP) = April, May, June;
Summer (SU) = July, Aug., Sept.; Fall (F) = Oct., Nov., Dec.

PLANT NAME	Antelope				Deer			
	W	SP	SU	F	W	SP	SU	F
Perennial grasses	P	P	P	P	D	P,D	D	D
Annual grasses	N	P,D	N	D	N	P,D	N	D
Sedges	D	P	P	P	D	P	P	P
Hairy goldenaster	E	E	E	E	E	E	E	E
Buckwheat spp.	N	D	U	N	N	D	U	N
Biscuitroot spp.	N	P	P	D	N	P	P	D
American vetch	P	P	P	P	D	P	P	P
Winterfat	P	P	P	P	P	P	P	P
Nuttall's saltbush	P	P	P	P	D	P	P	D
Wyoming big sagebrush	P	P	P	P	P	P	D	D
Rabbitbrush spp.	D	D	D	D	D	D	D	D
Slenderbush eriogonum	N	D	U	N	N	D	U	N
Greasewood	P	P	D	D	P	P	D	D
Longleaf sagebrush	D	D	D	D	D	D	D	D
Plains pricklypear	N	N	N	N	N	N	N	N
Broom snakeweed	N	N	D	N	D	D	P	P
Shadscale	D	D	D	D	D	D	D	D

14. Hydrology Data: The soils associated with this ecological site are generally in Hydrologic Soil Group D. The infiltration rates for these soils will normally be slow. The runoff potential for this site is high to very high, depending on slope and ground cover/health. Runoff curve numbers generally range from 85 to 94.

The hydrologic condition of this site has a significant affect on runoff. The hydrologic condition considers the effects of cover, including litter, and management on infiltration. Good hydrologic condition indicates that the site usually has a lower runoff potential. (Reference: Engineering Field Manual, Chapter 2 and Montana Supplement 4).

15. Recreation and Natural Beauty: This site supports sparse vegetation and recreational access is often difficult. This site provides valuable open space and visual aesthetics.

16. Wood Products: None

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17. Site Documentation:

Authors: Original: REL, AJN, 1983 Revised: JVF, REL, RSN, MJR, SKW, SVF, POH, 2003

Supporting Data for Site Development:

NRCS–Production & Composition Record for Native Grazing Lands (Range-417): 3
BLM–Soil & Vegetation Inventory Method (SVIM) Data: 6
NRCS–Range Condition Record (ECS-2): 2
NRCS–Range/Soil Correlation Observations & Soil 232 notes: 9

Field Offices where this site occurs within the state:

Baker	Ekalaka	Hysham	Sidney
Billings	Forsyth	Jordan	Terry
Broadus	Glendive	Miles City	Wibaux
Circle	Hardin	Roundup	

Site Approval: This site has been reviewed and approved for use:

Rhonda Sue Noggles
State Rangeland Management Specialist

06/30/03
Date

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Plant Community 1
HCPC / PPC
Rosebud County



Shale 10 – 14"
Sedimentary Plains, east
Carter County



Shale 10 – 14"
Sedimentary Plains, east
Plant Community 2
Rosebud County

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Shale 10 – 14"
Sedimentary Plains, east
Plant Community 2



Shale 10 – 14"
Sedimentary Plains, east
Plant Community 2
Carter County



Shale 10 – 14"
Sedimentary Plains, east
Plant Community 3

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**Shale 10 – 14”
Sedimentary Plains, east
Plant Community 3**



**Shale 10 – 14”
Sedimentary Plains, east
Plant Community 3
Carter County**